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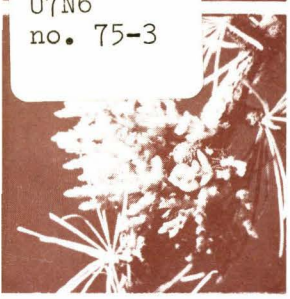

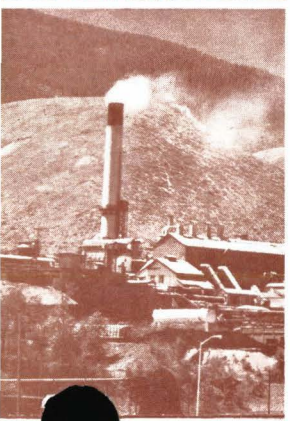

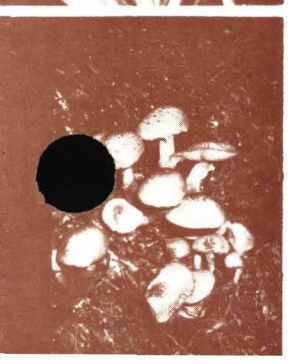

FOREST ENVIRONMENTAL PROTECTION

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POTENTIAL FOR DEFOLIATION BY WESTERN SPRUCE BUDWORM IN DOUGLAS-FIR STANDS IN EASTERN MONTANA 1975

by

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ABSTRACT

Aerially visible defoliation by the western spruce budworm, Choristoneura occidentalis Freeman, increased from 149,250 acres in 1973 to 649,319 acres in 1974 on five eastern Montana National Forests. An egg mass survey during the fall of 1974 predicted that additional defoliation will occur in 1975 on 47 of 48 plots located on these Forests. Areas with the highest potential for increasing populations in 1975 are being considered as sites for pilot control projects of several promising chemical and biological insecticides.

INTRODUCTION

Acreage of visible defoliation by the western spruce budworm, Choristoneura occidentalis Free., has exceeded 4 million acres in the Northern Region for the last 4 years (Ciesla et al. 1971, 1972; Dooling and Dewey 1973).

Fluctuations in budworm populations have resulted in erratic defoliation intensities in Montana Forests, particularly east of the Continental Divide. Area of visible defoliation within east side Forests from 1971 to 1974 is shown in Table 1. Visible defoliation declined from 756,260 acres in 1972 to 149,250 in 1973, then significantly increased to 649,319 acres in 1974.

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EXPERIMENT STATION

Within some Montana forests, the western spruce budworm has caused significant top kill, growth loss, mortality of regeneration and pole-size stands, and a serious reduction in annual amount of seed and cone crops produced (Dewey, 1972, Bousfield et al., 1973).

Because of the land managers concern for the widespread impacts this insect can impose on the forest ecosystem and the sharp increase in number of acres of visible defoliation in 1974, an egg mass survey was conducted to determine the potential for defoliation in 1975.

METHODS

Two 30-inch branches were cut from midcrown on opposite sides of five 20- to 45-foot high trees per plot. Branch samples were placed in nylon bags, transported to Missoula, and stored under refrigeration until examination.

In the laboratory, square inches of foliage on each branch are determined, and old and new (1974) egg masses were removed and separated. From these data, the number of new egg masses per thousand square inches of foliage in each plot was computed and the ratio of new to old egg masses determined.

Terrell (1966) developed a regression which correlated new egg masses per thousand square inches of foliage with subsequent percent defoliation of current foliage the following year. This regression was used to predict expected defoliation on each plot in 1975.

RESULTS

The number of acres of visible defoliation from the air increased since 1973 on five eastern Montana National Forests (Table 1). (Figures 1-5).

Predicted defoliation ranged from 0 to 80 percent. Only one plot had 0 percent defoliation potential. This indicates there will be some degree of defoliation on the remaining 47 plots in 1975 (Table 2). New egg masses exceeded old egg masses on all but three of the 48 plots sampled.

Table 1.--Acres of aerially visible western spruce budworm defoliation in eastern Montana from 1971 to 1974.

National Forest	Acres of visible defoliation			
	1971	1972	1973	1974
Deerlodge	285,680	335,000	78,320	268,237
Helena	337,280	385,000	44,680	259,752
Beaverhead	15,000	21,000	14,500	48,770
Gallatin	15,260	15,260	11,400	54,026
Lewis and Clark	--	--	350	18,534
TOTALS	653,220	756,260	149,250	649,319

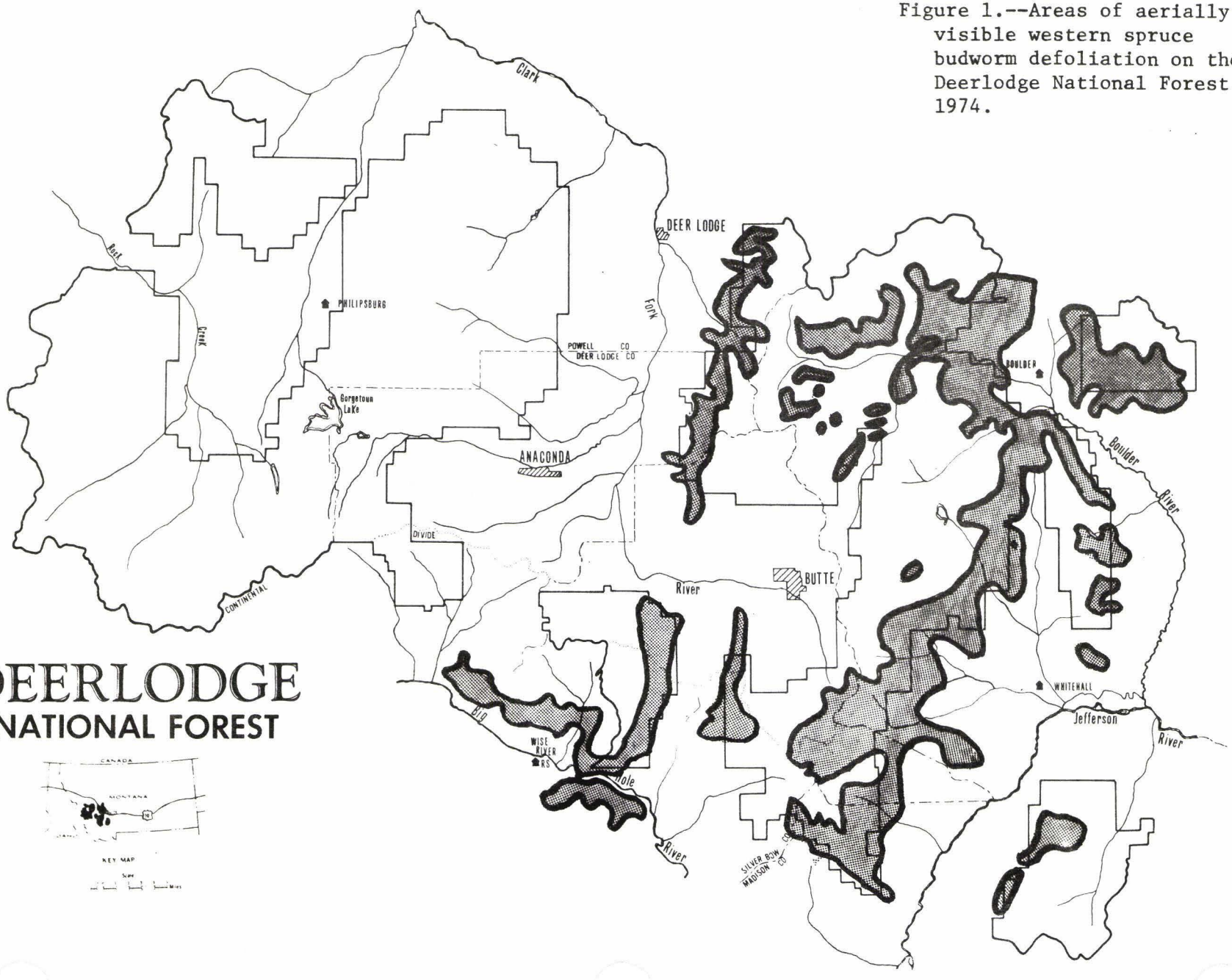

Figure 1.--Areas of aerially visible western spruce budworm defoliation on the Deerlodge National Forest 1974.

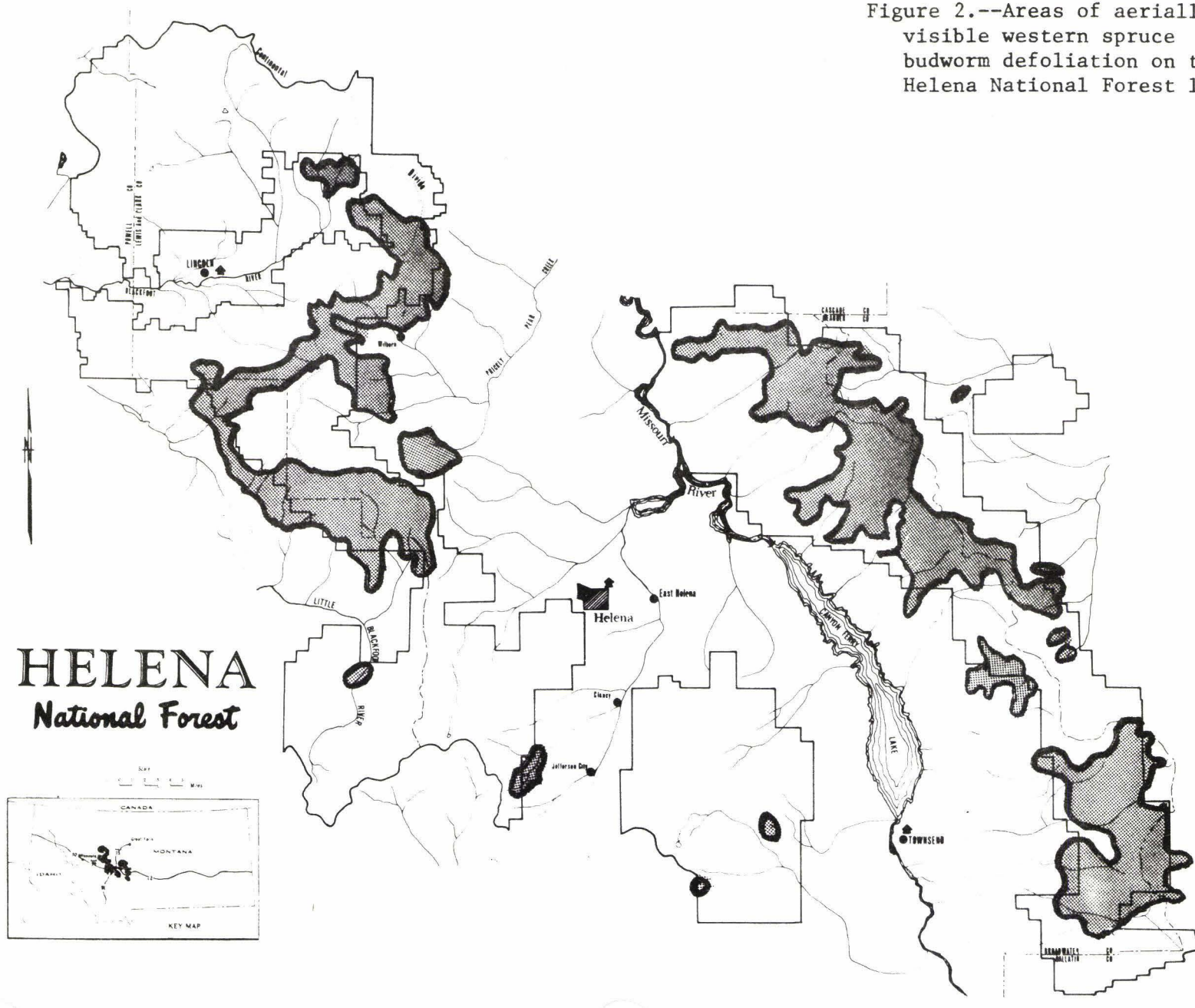

Figure 2.--Areas of aerially visible western spruce budworm defoliation on the Helena National Forest 1974.

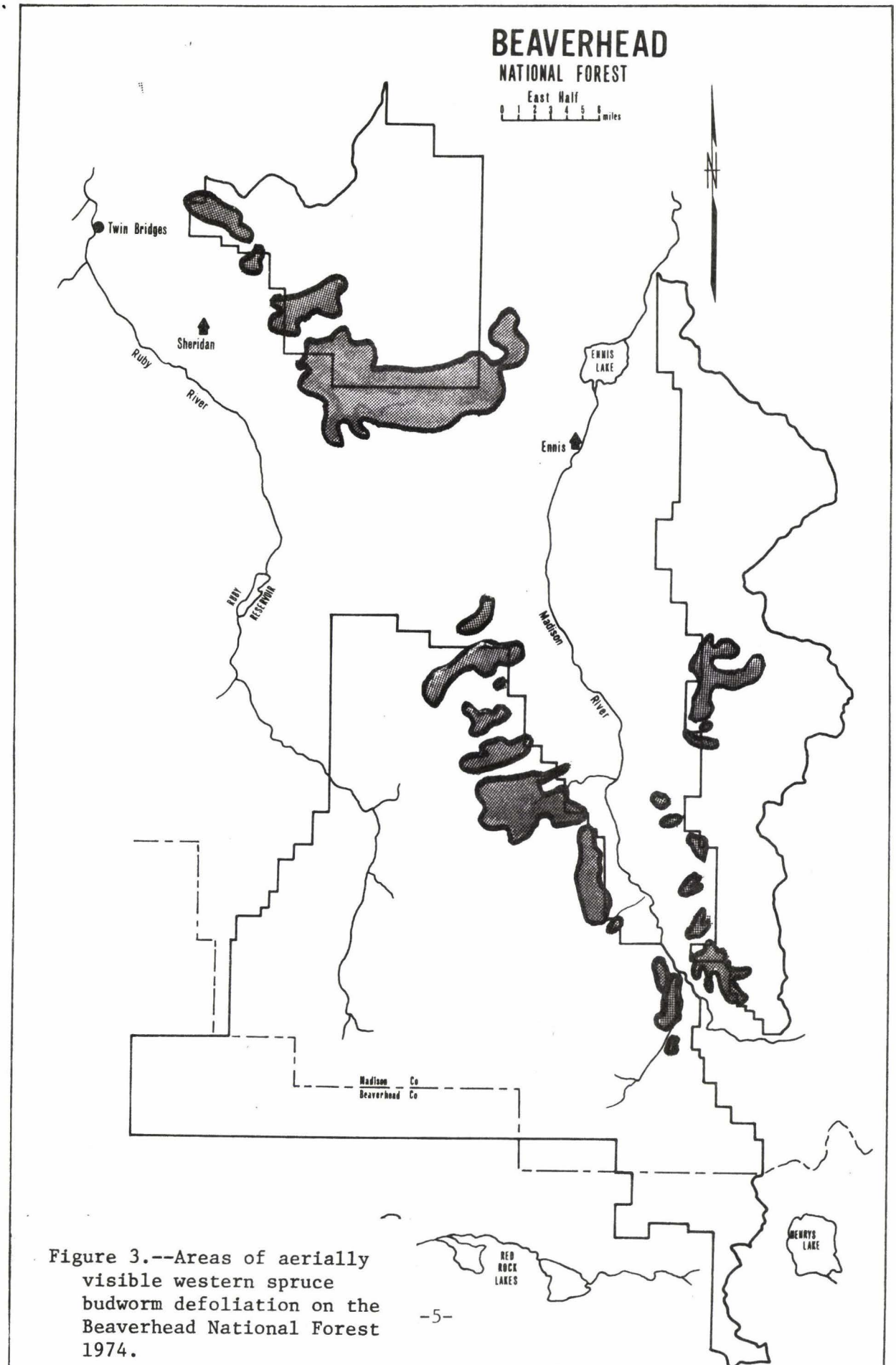

Figure 3.--Areas of aerially visible western spruce budworm defoliation on the Beaverhead National Forest 1974.

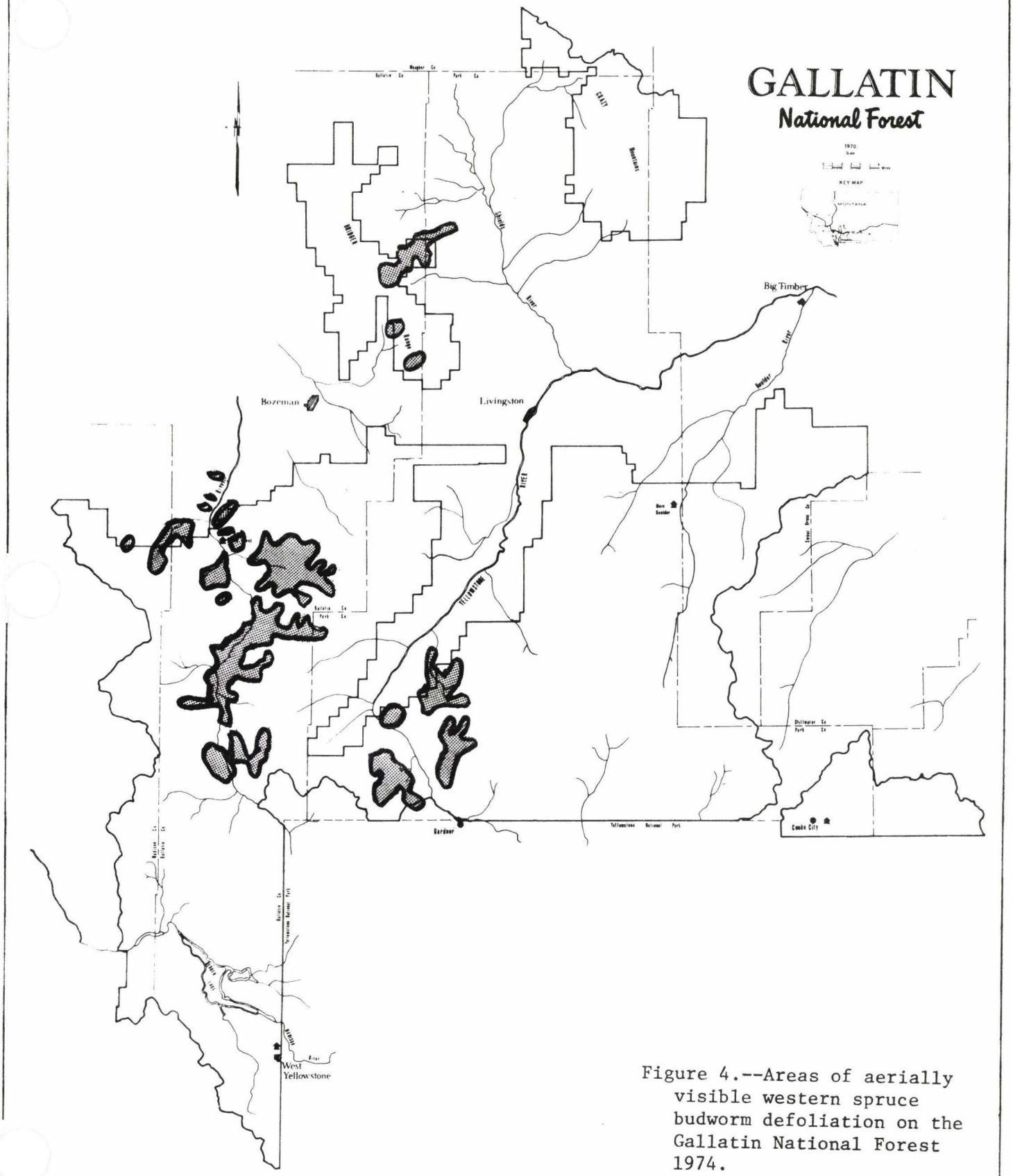

Figure 4.--Areas of aerially visible western spruce budworm defoliation on the Gallatin National Forest 1974.

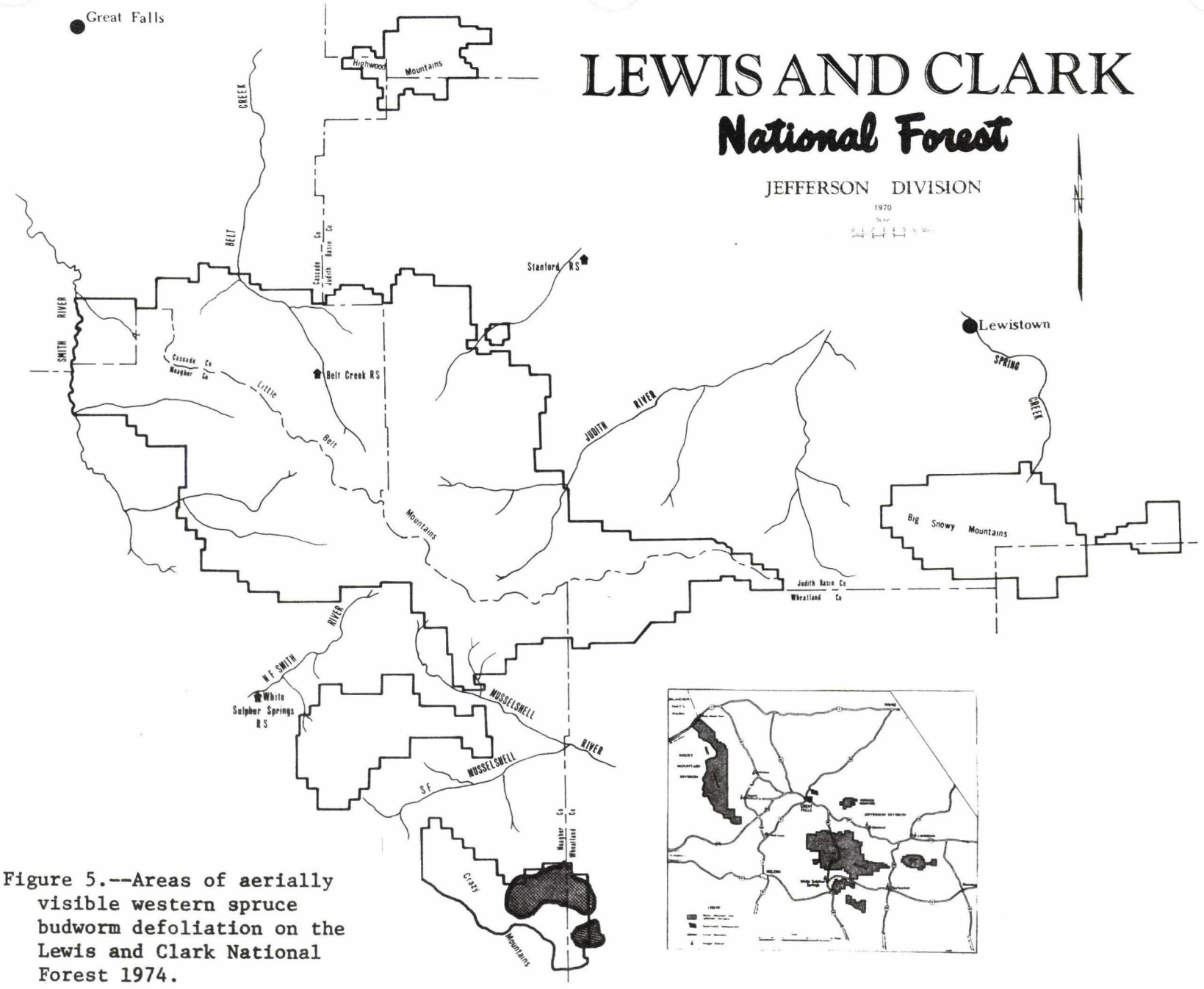

Figure 5.--Areas of aerially visible western spruce budworm defoliation on the Lewis and Clark National Forest 1974.

Table 2.--Potential defoliation in 1975 on western spruce budworm plots in eastern Montana.

Plot location	New egg masses per 1,000 square inches foliage	Predicted defoliation in 1975 (%)	New: old egg mass ratio
Gallatin National Forest			
T.1N., R.7E., sec. 4	0.2	5	1:1
T.2N., R.7E., sec. 32	.3	5	1:0
T.2N., R.7E., sec. 32	3.7	14	18:1
T.2N., R.7E., sec. 34	26.0	61	4.8:1
T.3N., R.10E., sec. 26	2.7	11	4:1
T.4S., R.4E., sec. 36	22.8	59	1.4:1
T.4S., R.5E., sec. 31	21.5	54	2.3:1
T.4S., R.12E., sec. 10	.2	5	1:0
T.5S., R.4E., sec. 1	12.9	35	1.7:1
T.5S., R.4E., sec. 36	32.1	66	5:1
T.5S., R.5E., sec. 11	2.9	14	5:1
T.5S., R.5E., sec. 18	32.9	69	2:1
T.5S., R.5E., sec. 19	6.4	22	24:1
T.5S., R.5E., sec. 30	18.3	49	2.3:1
T.6S., R.4E., sec. 32	11.1	33	1.9:1
T.6S., R.9E., sec. 12	.4	7	2:1
T.7S., R.4E., sec. 29	7.0	25	19:1
T.7S., R.4E., sec. 32	4.3	18	14:0
T.7S., R.8E., sec. 9	5.0	20	2.3:1
T.8S., R.4E., sec. 4	18.9	50	13.5:1
Beaverhead National Forest			
T.3S., R.2W., sec. 6	26.6	65	1.7:1
T.4S., R.2W., sec. 28	4.4	18	.7:1
T.5S., R.3W., sec. 26	32.8	68	3:1
T.7S., R.4W., sec. 23	9.9	30	2.3:1
T.8S., R.2W., sec. 1	33.6	69	2.5:1
T.9S., R.1W., sec. 7	20.8	52	2.9:1
T.9S., R.1W., sec. 8	53.7	80	1.7:1
T.9S., R.1W., sec. 18	28.2	63	1.4:1
T.9S., R.2W., sec. 13	7.2	24	5:1

Table 2.--Potential defoliation in 1975 on western spruce budworm plots in eastern Montana. (Continued)

Plot location	New egg masses per 1,000 square inches foliage	Predicted defoliation in 1975 (%)	New: old egg mass ratio
Helena National Forest			
T.6N., R.4E., sec. 24	30.6	65	2.7:1
T.6N., R.5E., sec. 9	19.4	51	1.3:1
T.7N., R.4E., sec. 12	30.3	65	2:1
T.7N., R.5E., sec. 21	5.4	19	2.9:1
T.9N., R.6W., sec. 30	17.7	49	2.9:1
T.10N., R.6W., sec. 2	13.3	38	3.8:1
T.10N., R.2E., sec. 1	30.9	65	2.9:1
T.12N., R.1E., sec. 7	32.5	67	2.5:1
T.12N., R.1E., sec. 34	24.6	60	2.9:1
T.12N., R.7W., sec. 1	9.7	30	1.2:1
T.12N., R.8W., sec. 22	8.5	26	1.6:1
T.13N., R.1W., sec. 27	1.8	7	2:1
T.13N., R.1E., sec. 30	52.6	76	2.7:1
T.13N., R.7W., sec. 12	2.5	11	.7:1
T.14N., R.6W., sec. 15	6.4	21	1.4:1
T.14N., R.6W., sec. 34	11.6	33	2.2:1
Lewis and Clark National Forest			
T.9N., R.9E., sec. 10	1.7	11	9:0
T.11N., R.7E., sec. 7	0	0	0:1
Deerlodge National Forest			
T.1N., R.9W., sec. 5	13.8	39	5.3:1

DISCUSSION

Western spruce budworm populations caused a significant increase in acreage of aerially visible defoliation in Douglas-fir stands on the Beaverhead, Deerlodge, Gallatin, Helena, and Lewis and Clark National Forests.

Douglas-fir is one of the nation's most important timber species. It is the principal cover type on over one-fourth (4,555,000 acres) of the commercial forest land in Montana (Wilson and Spenser, 1967). In 1970,

approximately 450 million board feet of Douglas-fir were harvested in Montana. Douglas-fir has ranked number one in volume cut in Montana since 1956.

In 1974, budworm larvae caused varying degrees of defoliation, removing both new and old growth foliage from the upper one-fourth to one-fifth of crowns of pole-size Douglas-fir within all infestations evaluated. Reproduction was completely defoliated in some infested stands in the Gravelly Range near Ennis, Montana. Continued defoliation in 1975 will result in growth loss to many trees.

Heavy feeding for several consecutive years will result in top kill and mortality of pole and reproduction size trees. Due to severe defoliation in stands that were infested with budworm on the Gallatin National Forest in the 1950's no regeneration is occurring in many areas. Top kill will reduce the cone crop for several consecutive years.

Although western budworm is recognized primarily as a foliage feeder, under epidemic conditions they prefer to feed in cones (Dewey 1972). Cone feeding by budworm, as well as other cone-feeding insects, in western Montana and northern Idaho has significantly reduced the cone crop on several Forests.

The egg mass survey shows that a sufficiently high budworm population is present to cause increased defoliation in 1975.

Because of the recurring nature of western budworm outbreaks and the potential for damage expected in 1975, pilot control tests are being considered to determine the effectiveness of promising chemical and biological insecticides as control agents for western budworm populations under operational conditions.

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